Regency® COMMUNICATIONS INC.

SERVICE MANUAL

TWO TONE
SEQUENTIAL DECODER

MODEL MA-301

1227 S. PATRICK DRIVE
SATELLITE BEACH FLA.

0300-4129-200

PRINTED IN U.S.A.
9-79

SERVICE INSTRUCTIONS

REGENCY MA-301

TWO TONE SEQUENTIAL DECODER

A. GENERAL DESCRIPTION

The MA-301 is a two tone sequential tone decoder with all-call capability. It is designed to interface with the MCA-611 and the MICRO-COM two-way radios.

The MA-301 is compatible with the MA-131, horn relay actuator option. Extreme care should be taken when interfacing the MA-301 with any non-recommended option; WHEN IN DOUBT CONSULT THE OPTION AND RADIO SCHEMATICS.

B. CIRCUIT DESCRIPTION (Refer to Block Diagram and Schematic)

Audio enters at A0 and is limited by CR505 and CR506. The audio is then filtered by a high-Q digital filter and the amplified output appears at Pin 1 of IC504. The voltage has to be 4 vpp in order to trigger the detector in IC503.

The audio is further amplified, output at Pin 7 of IC504, and is fed to the harmonic detector of IC503 (Pin 5). The harmonic detector will disable the decoder from detecting any harmonics of the tone to be decoded.

When the correct tone is present, the detector output, after being delayed, fires a one-shot. The one-shot time constant is set by R513, R514 and C509. Note that the one-shot timing can be varied by R514. This is adjusted to fit the users particular inter-tone timing.

Before going on with the decoding scheme, let's go back to the digital filter. This digital filter is an 8-pole filter. The filtered output frequency is determined from the clock frequency. The relation is $f_{clock}/8=f_{filter}$.

The clocks are gated from either Pin 1 of IC301 or IC302. The clock is selected by the oscillator switch outputs of IC503.

Tone A (first tone to be decoded) is selected by the adjustment of R508. Similarly tones B and C are selected by R503 and R504 respectively. Now let's return to the decoding sequence.

When tone A is received, the one-shot is fired. Oscillator switch 1 is grounded and oscillator switch 2 goes high (.5v). IC 502 is now the clock source and IC501 is used to alternate between the two clocks for tones B and C. The period of oscillation from Pin 1 of IC502 will be 200ms.

When the second tone has been received (tone B or tone C) before the one-shot has timed-out, the latch is set and D11 is grounded. This allows K7 to be pulled low and turns on Q504 via Q503, turning on the Message Lamp. When the MA-301 is used in the MCA-611 the Message Lamp is activated by the D11 pin going low.

Reseting the decoder is accomplished by driving Pin 13 IC503 to Less than 1V for at least 25ms. In the MCA-611 the reset switch is connected directly to D12. But in the case of the MICRO-COM radios, reseting is accomplished by removing the microphone from its hanger. This releases the ground from K5 turning off Q505. Removing the ground from K5 will also turn on Q506 grounding D11 and allowing the receiver to be placed in the monitor mode. Note that when used in MICRO-COM 2-way radios, JU501 is installed.

C. INSTALLATION

Plug the jumper kit between the option board and radio as follows:

FOR MCA-611 Remove JU501

Jumper P5 to P5
Jumper G to G
Jumper D12 to D12
Jumper D11 to D11
Jumper A0 to A0 (for two duty decoding Jumper A0 to S8)

FOR MICRO-COM RADIOS

Jumper P5 to P5
Jumper G to G
Jumper K5 to K5
Jumper K7 to K7
Jumper D0 to D0
Jumper A0 to A0

Mount the option board into the radio and insert the screws from the foil side of the board.

In MICRO-COM two-way radios only, two MA-301 decoders can be used together to provide four possible decoding schemes. To do this, connect the first decoder as described above and connect the second decoder as follows:

1. Connect P5 on decoder #2 to P5 in the radio.
2. Connect G on decoder #2 to G in the radio.
3. Connect A0 on decoder #2 to A0 in the radio.
4. Connect D12 on decoder #2 to D12 on decoder #1.
5. Connect D11 on decoder to D11 on decoder #1.

D. ADJUSTMENT PROCEDURE

1. Equipment
   a. High input impedance oscilloscope with accurate time base
   b. Signal generator
   c. Two tone sequential generator

2. Set-Up
   a. Connect radio to generator and power supply.
   b. Receiver should be tuned up for normal performance.
   c. Connect the oscilloscope to Pin 1 of IC501. Adjust R508 for proper period of oscillation.

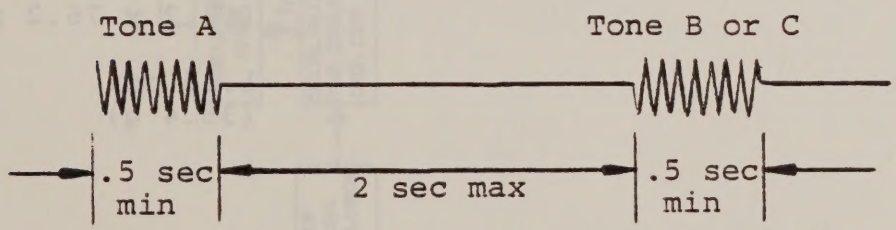
$$\text{period of osc.} = \frac{1}{8\text{x freq tone A}}$$

d. Modulate the RF generator with tone A.
e. Connect the oscilloscope to Pin 1 of IC502. Note that there are two oscillations alternating at a 5Hz rate.
f. Adjust R503 for the proper period of oscillation, i.e. 1/(8x freq tone B).
g. Adjust R504 for the proper period of oscillation, i.e. 1/(8x freq tone C).
h. Adjusting the one-shot.
    1. Modulate RF signal generator with tone A.
    2. Connect oscilloscope to Pin 17 of IC503.
    3. Adjust period of osc. for this time period:
       one-shot period = period 1st tone + period delay + period 2nd tone
k. Modulate RF signal generator with a two tone sequence.
l. The Message Lamp will come on and the squelch will open.

3. Alternate method
When a scope with an accurate time base is not available, this method can be used instead of sections c through g in part 2.

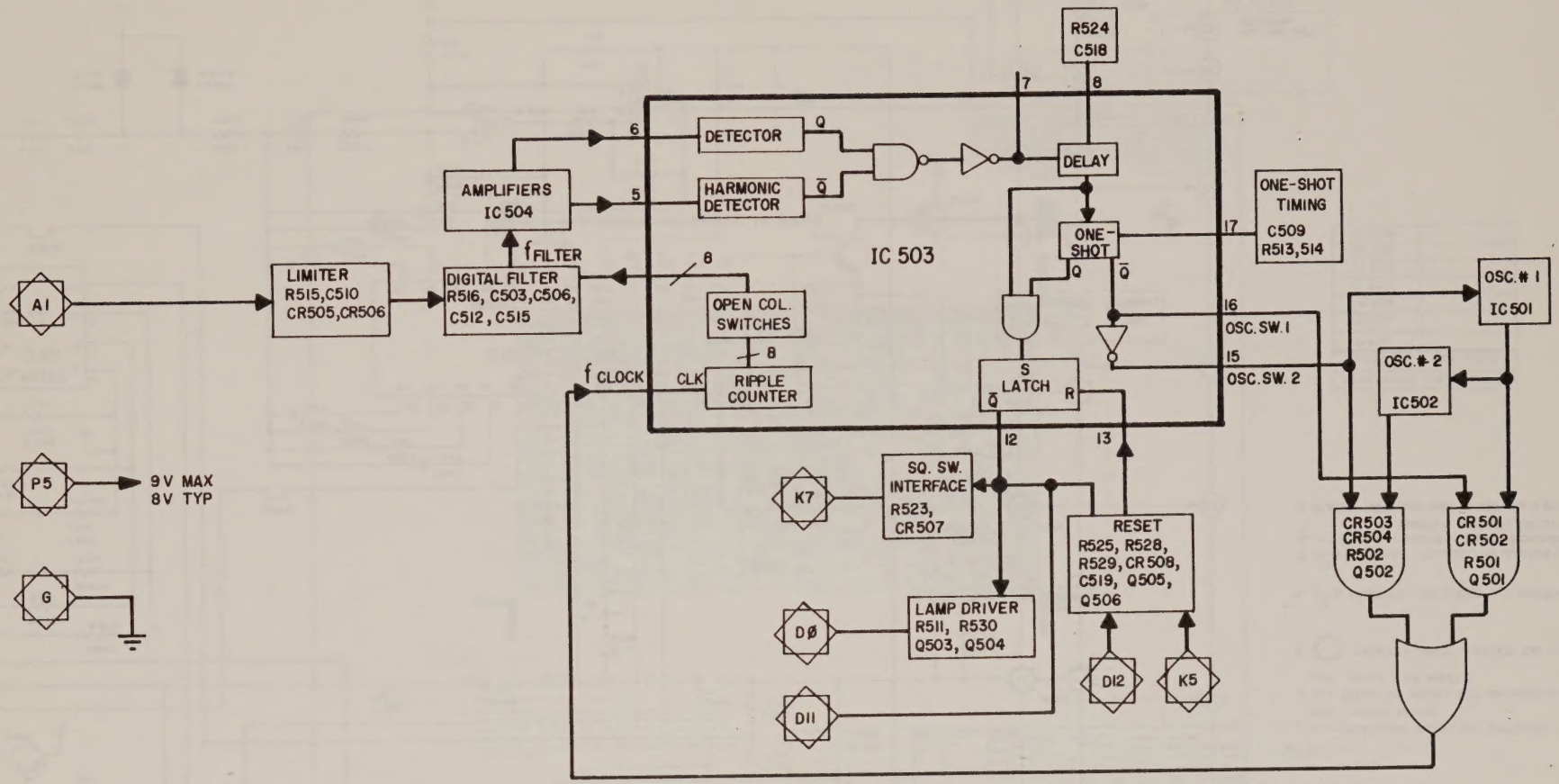
a. Equipment
    1. High input impedance amplifier, preferably 20dB in gain.
    2. Fairly accurate frequency counter (+1%)
b. Connect the input of the amplifier to Pin 2 of IC501 and the output of the amplifier to the frequency counter.
c. Adjust R508 so the frequency counter reads 8 x tone A freq.
d. Connect amplifier input to Pin 1 of IC502.
e. Unsolder one end of JU507 (Jumper connecting Pin 1 of IC501 to Pin 7 of IC502).
f. Ground Pin 7 of IC502.
g. Adjust R503 so the frequency counter reads 8 x tone B freq.
h. Remove the ground from Pin 7 of IC502.
i. Adjust R504 for 8 x tone C freq. on frequency counter.
j. Solder back the free end of JU507.

PROPER TONE SEQUENCE

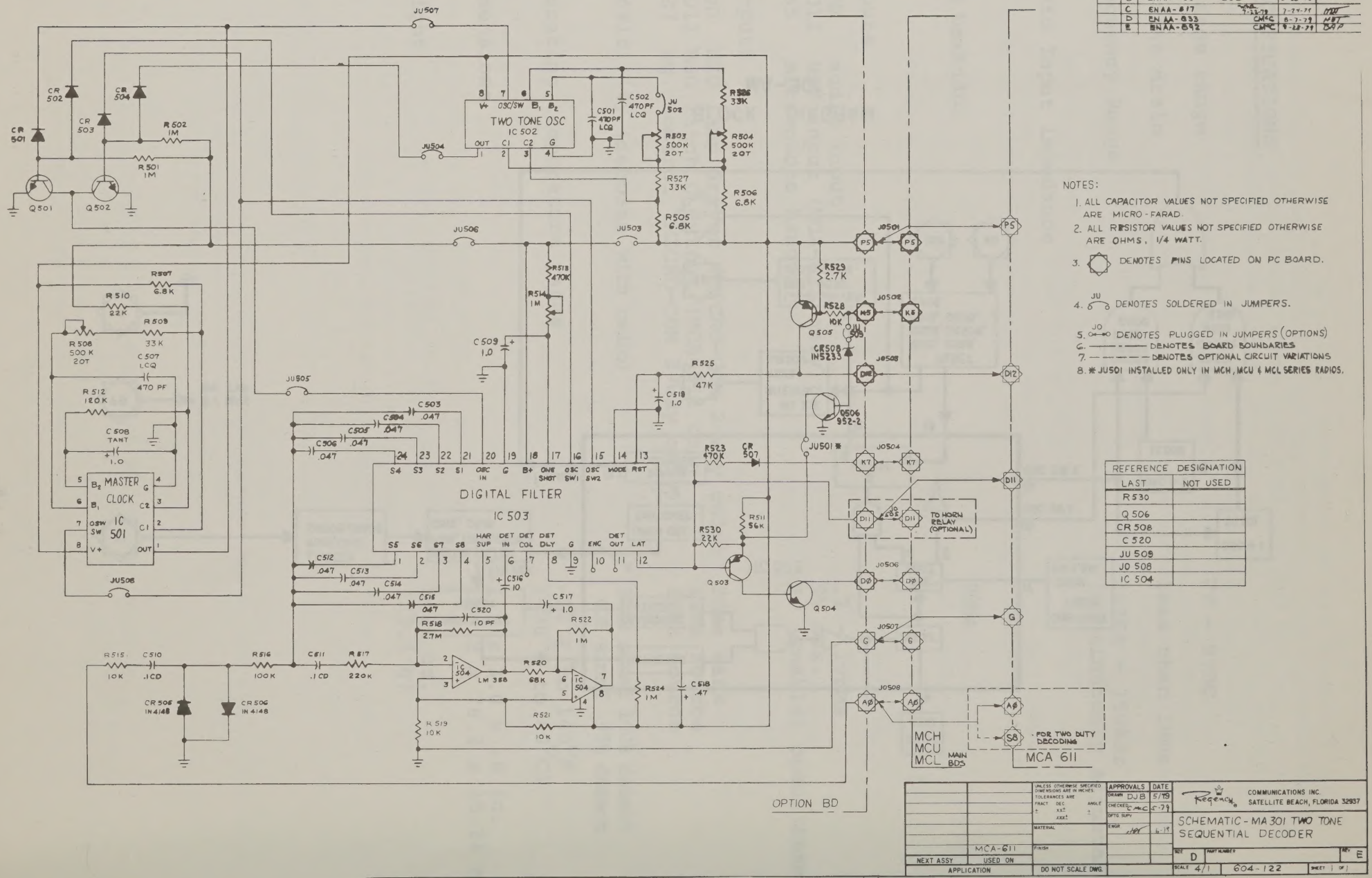


E. SPECIFICATIONS

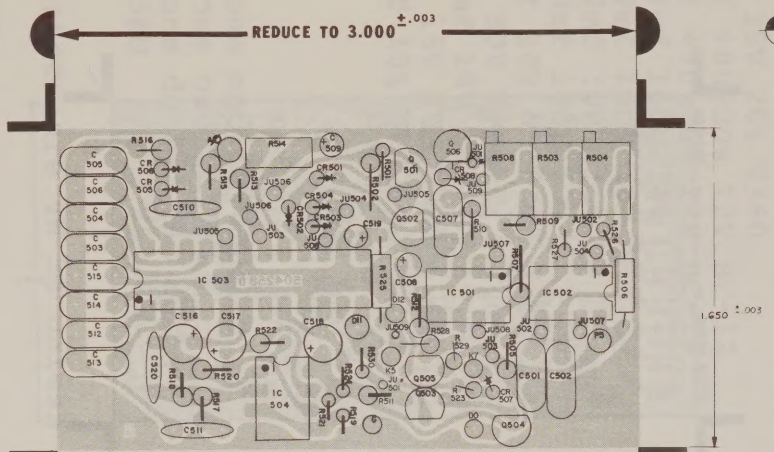
Voltage range	7V - 9VDC
Current drain	less than 10ma
Frequency Range	208Hz - 3906Hz (continuously adjustable)
Audio Input impedance	
6dB bandwidth	20Hz
Inputs	
A0 audio input	.2 - 1vrms
D12 RST input (MCA-611 only)	9V max.
K5 Microphone hangup	0v (enable) open (reset)
Outputs	
D0 MSG lamp driver (MICRO-COM 2-way only)	30ma sink
D11 MSG latch Q output (MCA-611 only)	13ma source
K7 sq. control (MICRO-COM 2-way only)	15ma source
Sensitivity (decoder with radio)	12dB sinad 100% detect 6DB sinad 95% detect
Operating temperature range	$-22^{\circ}F$ to $140^{\circ}F$ ($-30^{\circ}C$ to $60^{\circ}C$)
Dimensions	1.7 x 3.0 x .6 in. (43.2 x 76.2 x 15.24 mm)
Weight	1.25 oz. (35.4 g)



BLOCK DIAGRAM
MA-301


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
A R-148 DJB 5-24-79
B ENAA-790 DJB 6-20-79
C ENAA-817 7-23-79
D EN AA-833 CMPC 8-7-79
E ENAA-892 CMPC 9-28-79
JU507
JU504
JU506
JU503
JU505
JU508
CR 501
CR 502
CR 503
CR 504
R 501 1M
R 502 1M
Q501
Q502
TWO TONE OSC IC 502
C501 470PF LCQ
C502 470PF LCQ
JU 502
R503 500K 20T
R504 500K 20T
R505 6.8K
R506 6.8K
R527 33K
R536 33K
R507 6.8K
R510 22K
R508 500K 20T
R509 33K
C507 LCQ 470 PF
R512 120K
C508 TANT 1.0
MASTER CLOCK IC 501
R514 1M
R518 470K
C509 1.0
R525 47K
C518 1.0
DIGITAL FILTER IC 503
C503 .047
C504 .047
C505 .047
C506 .047
C512 .047
C513 .047
C514 .047
C515 .047
C516 10
C517 1.0
C520 10 PF
R518 2.7M
R522 1M
R515 10K
C510 .1CD
R516 100K
C511 .1 CD
R517 220K
IC 504 LM 388
R520 68K
R521 10K
R524 1M
C519 .47
R519 10K
CR 505 IN4148
CR 506 IN4148
R529 2.7K
R528 10K
Q505
JU 505
CR508 IN5233
Q506 952-2
JU501 *
R523 470K
CR 507
R511 56K
R530 22K
Q503
Q504
TO HORN RELAY (OPTIONAL)
J0501
J0502
J0504
J0506
J0507
J0508
P5
K5
K6
K7
D12
D11
DØ
G
AØ
S8
MCH
MCU
MCL MAIN BDS
FOR TWO DUTY DECODING
MCA 611
OPTION BD
NOTES:
1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE MICRO-FARAD.
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4 WATT.
3. DENOTES PINS LOCATED ON PC BOARD.
4. JU DENOTES SOLDERED IN JUMPERS.
5. JO DENOTES PLUGGED IN JUMPERS (OPTIONS)
6. DENOTES BOARD BOUNDARIES
7. DENOTES OPTIONAL CIRCUIT VARIATIONS
8. * JU501 INSTALLED ONLY IN MCH, MCU & MCL SERIES RADIOS.
REFERENCE DESIGNATION
LAST NOT USED
R 530
Q 506
CR 508
C 520
JU 509
JO 508
IC 504
APPROVALS DATE
DRAWN DJB 5/79
CHECKED 6-19
ENGR 6-19
COMMUNICATIONS INC. SATELLITE BEACH, FLORIDA 32937
SCHEMATIC - MA 301 TWO TONE SEQUENTIAL DECODER
SIZE D PART NUMBER 604-122 REV. E
SCALE 4/1 SHEET 1 OF 1
MCA-611
NEXT ASSY USED ON
APPLICATION
DO NOT SCALE DWG.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	FC 148	5/2/79	
	B	ENAA-790 DJB		
	C	ENAA-817		
	D	ENAA-833 CMC		



NOTES:

1. FOR PHOTO REDUCTION, HOLD ALL DIMENSIONS TO INSIDE OF HEAVY LINES.
2. THIS ARTWORK IS A POSITIVE.
3. SILKSCREEN COMPONENT DESIGNATION (LEGEND) ON THE COMPONENT SIDE OF THE P.C. BOARD WITH STANDARD BLACK NO. 6511 ETHYL CELLULOSE POSTER INK, AS SUPPLIED BY THE NAZDAR CO., CHICAGO, ILLINOIS OR ENGINEERING APPROVED EQUIVALENT.

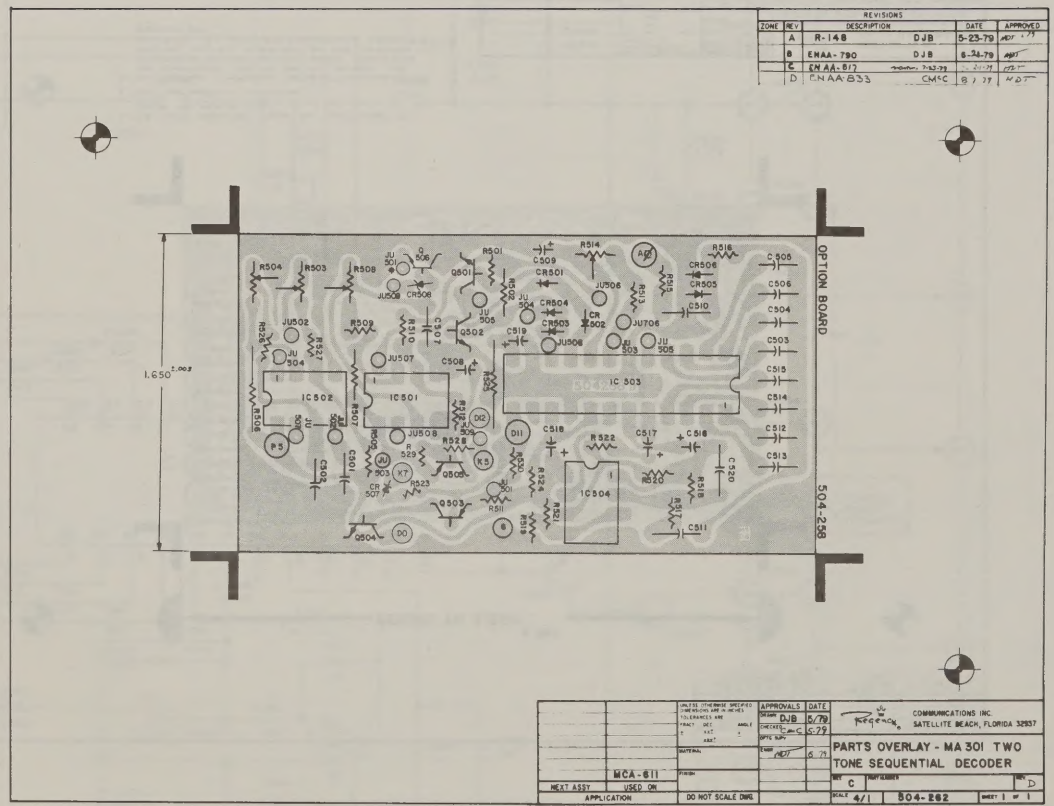
			APPROVALS	DATE
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACT DEC ANGLE ± .XX ± ± .XXX ±	DRAWN DJB	5/79
			CHECKED CMC	5/79
			ENGR HOT	6/79
		MATERIAL		
		FINISH		
NEXT ASSY	USED ON	MCA-611		
APPLICATION		DO NOT SCALE DWG		

COMMUNICATIONS INC. SATELLITE BEACH, FLORIDA 32937

PARTS PLACEMENT/SILKSCREEN - MA 301 TWO TONE SEQ. DECODER

SIZE C | PART NUMBER | REV D

SCALE 4/1 | 504-261 | SHEET 1 OF 1



REVISIONS					
ZONE	REV	DESCRIPTION		DATE	APPROVED
	A	R-148	DJB	5-23-79	MDT
	B	ENAA-790	DJB	8-24-79	MDT
	C	ENAA-817	[illegible]	[illegible]	MDT
	D	ENAA-833	CMSC	8/27	MDT

APPROVALS	DATE
DJB	5/79
[illegible]	6-79
MDT	5-79

COMMUNICATIONS INC.
SATELLITE BEACH, FLORIDA 32937

PARTS OVERLAY - MA 301 TWO TONE SEQUENTIAL DECODER

NEXT ASSY	USED ON
	MCA-611

APPLICATION — DO NOT SCALE DWG

REV C — PART NUMBER — REV D

SCALE 4/1 — 504-262 — SHEET 1 OF 1

PARTS LIST

LOCATION	DESCRIPTION	PART NUMBER
CAPACITORS		
C501	470pf 50V 5% LCQ 17	1506-0471-550
C502	470pf 50V 5% LCQ 17	1506-0471-550
C503	.047mf 100V 10%	1508-0473-610
C504	.047mf 100V 10%	1508-0473-610
C505	.047mf 100V 10%	1508-0473-610
C506	.047mf 100V 10%	1508-0473-610
C507	470pf 50V 5% LCQ 17	1506-0471-550
C508	1mf 15V 20% T360	1515-0010-003
C509	1mf 15V 20% T360	1515-0010-003
C510	.1uf +80-20% 12V BC-12	1502-0104-006
C511	.1uf +80-20% 12V BC-12	1502-0104-006
C512	.047mf 100V 10%	1508-0473-610
C513	.047mf 100V 10%	1508-0473-610
C514	.047mf 100V 10%	1508-0473-610
C515	.047mf 100V 10%	1508-0473-610
C516	10mf 10V 85D III Type U	1513-0100-001
C517	1mf 50V Type U	1513-0101-001
C518	.47mf 15V 20%	1515-0479-003
C519	1mf 15V 20% T360	1513-0010-003
C520	10pf 10% NPO 500V	1500-0100-605
INTEGRATED CIRCUITS		
IC501	2 tone osc SC74204	3130-6060-700
IC502	2 tone osc SC74204	3130-6060-700
IC503	2 tone dg fil SC74203	3130-6062-000
IC504	LM358N	3130-3167-909
RESISTORS (all resistors are ¼W 5% unless otherwise noted)		
R501	1 meg	4704-0105-032
R502	1 meg	4704-0105-032
R503	500K var	4751-5429-006
R504	500K var	4751-5429-006
R505	6.8K	4704-0682-032
R506	6.8K	4704-0682-032
R507	6.8K	4704-0682-032
R508	500K var	4751-5429-006
R509	33K	4704-0333-032
R510	22K	4704-0223-032
R511	56K	4704-0563-032
R512	120K	4704-0124-032
R513	470K	4704-0474-032
R514	1 meg	4751-0105-002
R515	10K	4704-0103-032
R516	100K	4704-0104-032
R517	220K	4704-0224-032
R518	2.7m	4704-0275-032
R519	10K	4704-0103-032

LOCATION	DESCRIPTION	PART NUMBER
R520	68K	4704-0683-032
R521	10K	4704-0103-032
R522	1 meg	4704-0105-032
R523	470K	4704-0474-032
R524	1 meg	4704-0105-032
R525	47K	4704-0473-032
R526	33K	4704-0333-032
R527	33K	4704-0333-032
R528	10K	4704-0103-032
R529	2.7K	4704-0272-032
R530	22K	4704-0223-032

TRANSISTORS

Q501	Blue top SPS 1476	4801-0000-003
Q502	Blue top SPS 1476	4801-0000-003
Q503	2N5447	4801-0000-135
Q504	SPS-952-2	4801-0000-016
Q505	2N5447	4801-0000-135
Q506	SPS-952-2	4801-0000-016

DIODES

CR501	diode germ	4807-1233-900
CR502	diode germ	4807-1233-900
CR503	diode germ	4807-1233-900
CR504	diode germ	4807-1233-900
CR505	diode sil IN4148	4805-1241-200
CR506	diode sil IN4148	4805-1241-200
CR507	diode sil IN4148	4805-1241-200
CR508	diode zener IN5233B	4808-0000-025